Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Promoting the Deployment of 5G Open Radio Access Networks	)	GN Docket No. 21-63
	)	

REPLY COMMENTS OF ERICSSON

Ericsson submits these reply comments in response to the Commission's Notice of Inquiry ("Notice"). The record broadly supports the conclusion that the Commission should continue its policy of supporting technological neutrality, with only a few outliers calling for Commission mandates regarding Open RAN.

I. INTRODUCTION

One thing is made clear from the comments: The Commission should foster a diverse, trusted market of suppliers—not just those headquartered in the U.S. Ericsson demonstrated, at length, its commitment to the U.S. market in our Comments. Where we are headquartered does not in any way diminish our commitment to delivering high performing, secure, and energy efficient network products to U.S. operators.

The suggestion in the *Notice* that the policy of the Commission should bolster the competitive advantage of U.S. Radio Access Network ("RAN") companies over "traditional network equipment vendors" presents the discussion as a debate over U.S. technology vs. technology from the rest of the world. Instead of viewing the current technological trend toward openness through the lens of geopolitics, as the Information Technology Industry Council states,

> [T]he FCC, as a part of broader U.S. policy, should expressly advance a diverse, trusted market of suppliers based in the United States as well as in allied and other partner

> market democracies. Only a multinational, diverse vendor base of trusted suppliers will have the capacity to service the U.S. and other partner countries' markets.[1]

Ericsson agrees with Samsung that while

> [w]idespread deployment of Open RAN will no doubt present beneficial opportunities for a wider range of U.S.-based companies to engage in the communications marketplace, [] to adequately supply their rapidly developing U.S. domestic 5G and next generation networks, U.S. carriers will need a diversity of trusted, competitive, innovative suppliers at global scale, not limited solely to U.S.-headquartered vendors.[2]

As stated in our Comments, Ericsson fully supports open network evolution and open competition, including competition from U.S.-based companies.

Commenters suggest a variety of steps the Commission can take, short of mandates, to support advances in Open RAN. Offering test beds, working with other government stakeholders to promote a global market of trusted vendors, and increasing participation in global standards all receive overwhelming support in the record as activities the Commission can undertake to support Open RAN advances.

The Open RAN Policy Coalition ("ORPC") provides a set of recommendations that Ericsson endorses:

> Greater access to 5G-capable spectrum resources and new infrastructure (including both towers and small cells) will afford operators more flexibility to incorporate and transition more parts of the network to open interfaces at scale. Likewise, more broadband deployment even outside the 5G context, such as efforts to expand coverage in remote areas, will further facilitate the adoption of Open RAN."[3]

Access to spectrum, new infrastructure, and expansion of coverage are exactly the policies the Commission has, and should continue, to advance to ensure U.S. 5G leadership. As Ericsson noted in its comments, the Commission should focus first and foremost on promoting

[1] Information Technology Industry Council Comments, GN Docket No. 21-63, at 10 (filed Apr. 28, 2021).
[2] Samsung Comments, GN Docket No. 21-63, at 5 (filed Apr. 28, 2021).
[3] Open RAN Policy Coalition Comments, GN Docket No. 21-63, at 33 (filed Apr. 28, 2021).

5G deployment, not on promoting particular types of 5G networks. The best way for the Commission to ensure the continued development of open networks is not to put its thumb on the scale but to advance 5G's proliferation, remain technology neutral, support test beds and American participation in crucial standard-setting bodies, and allow eligible carriers to choose freely among trusted vendors as they participate in the Commission's reimbursement program.

II. NETWORK ARCHITECTURE DECISIONS SHOULD BE MARKET BASED; NOT MANDATED

The overwhelming majority of commenters, including every nationwide wireless network operator, advocated that the Commission not issue any mandates or preferences with regard to operators' network architecture decisions:

- AT&T stated that "[w]hile the Commission can take steps to help accelerate and lay the foundation for O-RAN, the Commission should avoid taking steps that will distort the marketplace and negatively impact investment or slow down 5G deployments by requiring mobile operators to use particular technologies or vendors."[4]

- T-Mobile similarly cautions that "Commission involvement in Open RAN would likely mean the specification of RAN interfaces. But any government-led specification is difficult to change, and once-current Open RAN interfaces may become outdated and frozen in place. That will ultimately disadvantage consumers and put U.S.-based firms at a competitive global disadvantage."[5]

- Verizon does "not support any regulatory mandates that would force procurement or deployment of Open RAN solutions, as such mandates would be counterproductive to the ongoing deployment of advanced wireless networks and could undermine the future of Open RAN if operators are forced to deploy it prematurely."[6]

It is not just nationwide wireless operators who are opposed to technology mandates or preferences. Google also notes that "ORAN has developed primarily through industry initiatives, and the Commission should leave room for the market to continue to develop. Based on current approaches, it need not adopt mandates, set-asides, or preferences for ORAN (or for vRAN)."[7]

[4] AT&T Comments, GN Docket No. 21-63, at 7 (filed Apr. 28, 2021).
[5] T-Mobile Comments, GN Docket No. 21-63, at 4-5 (filed Apr. 28, 2021).
[6] Verizon Comments, GN Docket No. 21-63, at 9 (filed Apr. 28, 2021).
[7] Google Comments, GN Docket No. 21-63, at 7 (filed Apr. 28, 2021).

Commscope, a U.S.-headquartered wireline and wireless infrastructure provider, also cautions against any regulatory mandates. It contends that "mandates are unnecessary, particularly given that new Open RAN standards are still in development. Imposing new regulations that could, directly or indirectly, mandate specific standards, dictate hardware or software design, or impose costs on Open RAN industry participants risks distorting marketplace incentives and derailing ongoing Open RAN innovation."[8]

Ericsson is only aware of two commenters which actively support the Commission's taking an active role in tipping the scales in favor of Open RAN. Perhaps not surprisingly, given the sheer volume of marketing material contained in its submission, it is clear that Mavenir stands to gain from any potential Commission mandate that would favor Open RAN equipment. It asserts the Commission should, for example, *require* U.S. operators to prefer U.S.-headquartered suppliers when swapping out untrusted equipment.[9] As numerous commenters have observed, however, the *market* can, and should, determine what solutions are the best fit for operators. The U.S. Chamber of Commerce perhaps said it best: "The private sector is in the best position to develop and deploy the most appropriate and suitable technology to meet their customers' needs and mission requirements—including those of government customers—connected with the development, acquisition, use, and commercialization of 5G."[10] The Open RAN Policy Coalition itself, of which Mavenir is a "proud founding member,"[11] "strongly support[s] the industry leadership and carrier choice that is presently proving to be an effective and

[8] Commscope Comments, GN Docket No. 21-63, at 8 (filed Apr 28, 2021).
[9] Mavenir Comments, GN Docket No. 21-63, at 31 (filed Apr. 28, 2021).
[10] US Chamber of Commerce Comments, GN Docket No. 21-63, at 2 (filed Apr. 28, 2021).
[11] Press Release, *Mavenir Elected to OpenRAN Policy Coalition Board*, May 20, 2020, https://mavenir.com/press-releases/mavenir-elected-to-openran-policy-coalition-board/.

efficient path to the Open RAN future"[12] and notes that it "does not support government mandates or preferences that would govern how carriers build their networks."[13]

Dell, in an argument that poses something of a challenge to decipher, seems to suggest that the Commission should "mandate the U.S. buildout of Open RAN technologies" because operators' reliance on global entities for their wireless networks puts them at "great risk" as there is little visibility into those entities' continued viability (which would impact their ability to service and repair networks in the future).[14] From a visibility perspective, Ericsson is publicly traded in the U.S., and regularly files financial reports and makes them available to the public. From a viability perspective, Ericsson has been in business for 145 years, employees approximately 100,000 people, and operates in over 180 countries. There can be little doubt about Ericsson's viability.

Dell posits that an Open RAN mandate will "provide an assessment of existing risks in companies' supply chain" and "*allow them* to become less reliant on foreign entities." How a mandated Open RAN buildout will provide an assessment of supply chain risks is unclear. That aside, a Commission "mandate[d] U.S. buildout of Open RAN," limited to U.S.-headquartered companies, is not supported by the record.

Verizon does not favor any mandates forcing the "procurement or deployment of Open RAN solutions."[15] CTIA, whose members are among the most influential leaders in Open RAN offerings and deployment in the United States and worldwide,[16] notes that the "Commission should refrain from considering mandates or preferences for how providers build their networks, because in the case of Open RAN, government intervention would be counter-productive, impeding the progress that is presently underway."[17] Far from a mandate that "allows" operators to become

[12] ORPC Comments at 32-33.
[13] *Id.* at 32.
[14] Dell Comments, GN Docket No. 21-63, at 9 (filed Apr. 28, 2021).
[15] Verizon Comments at 9.
[16] *See* CTIA Comments, GN Docket No. 21-63, at 5 (filed Apr. 28, 2021).
[17] CTIA Comments at 11.

less reliant on foreign entities, the consensus is clear from the industry that mandated Open RAN would be counter-productive to the goals of building advanced wireless networks and keeping the U.S. at the forefront of 5G innovation.

III. REGULATORY AND OTHER BURDENS

The Commission sought comment on the regulatory burdens that stand in the way of Open RAN. The record is devoid of *any* identifiable regulatory burden to deploying Open RAN. The ORPC states that the Commission should "Identify and Address Regulatory Barriers to Open RAN"[18] but then does not point to any Open RAN barrier. Red Hat similarly throws the onus back on the Commission stating that it should "inventory any regulatory barriers," but does not provide any specifics.[19]

Although proving a negative is a difficult proposition, Ericsson posits that the reason there is no showing in the record of a regulatory barrier to deploying Open RAN is that, in fact, there *are no such barriers*. Qualcomm said it quite succinctly: "Qualcomm does not see any regulatory burdens to developing and deploying Open RAN technologies and does not believe the FCC needs to revise or implement any new regulations to promote Open RAN."[20] Similarly, Verizon is "unaware of any FCC regulatory position that favors one network architecture over another, and we are unaware of any constraints on Open RAN posed by any existing FCC rules."

Ericsson itself sees no barrier to deploying Open RAN solutions. Ericsson's Cloud RAN is a major step on the journey to a secure Open RAN solution that meets the needs of U.S. critical infrastructure. It allows operators to run Ericsson RAN software using non-Ericsson open hardware and the third-party cloud stack (*e.g.*, platforms provided by IBM / Red Hat Linux,

[18] ORPC Comments at 5.
[19] Red Hat Comments at 9.
[20] Qualcomm Comments at 7.

HPE, Intel, and many others). Ericsson has every reason to ensure that the regulatory environment is not unfavorable to our own Open RAN products. We can find nothing that would impede our foray into the marketplace for Open RAN products and services.

IV. SECURITY

3GPP has produced secure, open, and interoperable standards for each generation of cellular technology. 5G is the most secure generation of cellular networks that 3GPP has standardized to date, providing security end-to-end across the network through the RAN, core, transport and service-based architecture.

Industry, in coordination with internationals standards development organizations such as 3GPP and O-RAN Alliance, are now working to develop Open RAN technologies. The benefits of Open RAN are open interfaces, cloudification, intelligence, and automation to enable increased vendor diversity, deployment flexibility, higher performance, and greater resiliency in the 5G RAN. Ericsson agrees with Google's assessment that "[u]se of Open RAN itself will not directly result in more secure networks, but it can provide the transparency, vendor choice, and common control software that enable more secure implementations."[21] As we stated in our Comments, Ericsson also cautions that "the Commission should recognize that Open RAN may, in fact, create security risks."[22] While Qualcomm's stated position is that "[i]t is a misconception that disaggregation of the RAN increases the attack surface," the O-RAN Alliance's Security Focus Group ("SFG"), which is supported by operator members, has adopted official work items to address new security risks from O-RAN's attack surface.

Ericsson Cloud RAN achieves the goals of Open RAN while avoiding the security risks introduced by O-RAN's modified architecture with additional interfaces, functions, and

[21] Google Comments at 5.
[22] T-Mobile comments at 12.

architectural modifications. Cloud RAN is based upon 3GPP and O-RAN Alliance standards that leverages cloud-native technologies to handle compute functionality in the RAN while providing flexible deployment models for use of private, public and hybrid clouds. O-RAN is a modified Open RAN architecture specified by the O-RAN Alliance with additional interfaces, functions and architectural changes built on 3GPP standards with the purpose to enable increased vendor diversity in the RAN. Cloud RAN and O-RAN share common security risks from cloud deployments and use of open source software.

While the cloud introduces security benefits, it also introduces security risks, as has been experienced with recent cybersecurity attacks through the cloud. The key objective with security in any RAN is ensuring privacy, performance, and resiliency. Operators should perform risk analyses prior to deploying Open RAN to understand the likelihood and impact of risks, and to implement appropriate security controls. For our part, Ericsson is applying industry best practices when it comes to security for Ericsson Cloud RAN—including DevSecOps—to ensure Cloud RAN is secure.

Open RAN security has a higher minimum security baseline when the goal is zero-trust networks. Ericsson agrees with AT&T and Verizon that a zero-trust approach should be taken with 5G networks. Open RAN deployments should be secure with zero-trust at all layers of the networking and technology stack to ensure only trusted entities can have access and move internally within the network.

O-RAN Alliance specifications provide a modified RAN architecture. The O-RAN Alliance specifications provide an alternate RAN architecture with a Lower-Layer Split (LLS) and Near-RT-RIC with xApps that introduce new security risks. The SFG is analyzing these risks to add proper mitigations to O-RAN specifications. Implementation of O-RAN architecture

will require additional due diligence from operators to ensure that the level of security provided by their 3GPP networks is met by O-RAN. Security best practices such as end-to-end security, zero-trust architecture, perimeter firewalls, and cloud security, are areas for the SFG to address in the future.

Open source software ("OSS") provides security benefits while introducing new security risks. Regarding OSS, Ericsson agrees with T-Mobile "[t]he fact that Open RAN relies on open source software increases the number of potential entry points for security breached,"[23] and Verizon's assessment that "[t]he main disadvantage to open source software is that attackers can review the version history of a given open source project and identify open source software dependencies that may have had known vulnerabilities reported."[24] While open source developers behave as "good citizens" in which consumers also contribute, provide useful feedback, and share fixes, malicious backdoors can be intentionally inserted by hackers and contributors from untrusted suppliers in adversarial nations.[25] While transparency of code reviewed by many expert eyeballs can reduce software complexity and the number of bugs, attackers can also review code to identify vulnerabilities to exploit.

Ericsson is a strong proponent of OSS when it is used with proper due diligence in development projects. While OSS reduces fragmentation and increases interoperability among different products by producing components and protocols that become the *de facto* standard, OSS is not inherently secure. 'Trees of dependencies' make it difficult to ensure all instances of use of the code are patched as OSS vulnerabilities can also propagate through reuse. The Github 2020 State of the Octoverse Report concluded that vulnerabilities often go undetected for more

[23] T-Mobile Comments at 12.
[24] Verizon Comments at 15.
[25] *See*, REMARKS OF FCC CHAIRMAN AJIT PAI TO THE CENTER FOR STRATEGIC AND INTERNATIONAL STUDIES, at 2, available at https://docs.fcc.gov/public/attachments/DOC-369080A1.pdf.

than four years before being disclosed,[26] a research-based conclusion that conflicts with the narrative that OSS is patched *faster* than proprietary software. Ericsson agrees with The Linux Foundation and The Laboratory for Innovation Science at Harvard's joint report on the 2020 FOSS Contributor Survey that states "[t]here is a clear need to dedicate more effort to the security of FOSS…. respondents report spending very little of their time on responding to security issues (an average of 2.27% of their total time spent)"[27] and the Linux Foundation's Open Source Software Supply Chain Security report from February 2020 that concluded "[u]nless and until the weaknesses inherent within their current designs and procedures are addressed, however, they will continue to expose the companies and developers who rely upon them to significant risk."[28] Ericsson practices a mature and industry leading Security Reliability Model that includes best development practices such as secure coding, internal cataloging of software libraries (*e.g.* Software Bill of Materials), transparent auditing processes, and well-defined root of trust across all solution components.

Some of the responses to the Commission show a conflation among Open Network Automation Platform ("ONAP"), the Open Networking Foundation ("ONF"), and O-RAN. These are separate organizations hosting distinct open source projects to address different parts of the networking stack with varying levels of security. These open source projects are complementary, but can be singularly deployed and should not be conflated.

[26] *See* The 2020 State of the Octoverse, https://octoverse.github.com/ (last visited May 18, 2021).
[27] Report on the 2020 FOSS Contributor Survey at 8, The Linux Foundation, Dec. 2020, https://www.linuxfoundation.org/wp-content/uploads/2020FOSSContributorSurveyReport_121020.pdf.
[28] Open Source Software Supply Chain Security, The Linux Foundation, Feb. 2020, https://www.linuxfoundation.org/wp-content/uploads/oss_supply_chain_security.pdf.

V. THE FUTURE OF OPEN RAN

The Commission sought comment on the costs and benefits of deploying Open RAN equipment. Without offering any support, Mavenir makes sweeping declarations regarding Open RAN's supposed cost savings (*e.g.*, "Open RAN is more cost-efficient and less resource intensive compared with hardware-based proprietary networks"[29]). Making such assertions is easy; backing them up with evidence is much more difficult. The reality is that building wireless networks is a complex undertaking. In the case of adding Open RAN to existing networks, Parallel Wireless suggested operating costs could be as much as 30-50% higher.[30] Even Rakuten, offering the possibility of showcasing Open RAN in a completely new network, likely underestimated integration costs, as well as network construction costs.[31]

As T-Mobile observes, "implementation costs incurred by providers include labor, power, backhaul, site lease, and spectrum costs. Any reductions in equipment cost may be so insignificant as to be meaningless to consumer costs, but will complicate and likely slow network implementation."[32]

Open RAN has many opportunities ahead, and Ericsson, as evidenced by its leadership positions in the O-RAN Alliance and demonstrated commitment to Open RAN with its Cloud RAN solution, is playing an active role in its continued development.[33] Today, the vast majority of Open RAN networks are still only trialing Open RAN—in itself an indication nascent state of

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[29] Mavenir Comments at 20.
[30] *See* Steve Papa*, What happens to deployment TCO when mobile operators deploy OpenRAN only for 5G? (Reader Forum),* RCR Wireless News, May 22, 2020, https://www.rcrwireless.com/20200522/opinion/readerforum/deployment-tco-mobile-operators-deploy-openran-reader-forum.
[31] *See* Matt Kapko, *Is Rakuten the Best or Worst Example of Open RAN?*, SDX CENTRAL, May 17, 2021, https://www.sdxcentral.com/articles/news/is-rakuten-the-best-or-worst-example-of-open-ran/2021/05/; and Wei Shi, *Rakuten receives a $2 billion capital injection*, TELECOMS.COM, March 15, 2021, https://telecoms.com/508994/rakuten-receives-a-2-billion-capital-injection/.
[32] T-Mobile Comments at 5-6.
[33] *See* Ericsson Comments, GN Docket No. 21-63, at 13-29 (filed Apr. 28, 2021).

the technology for use at scale. Contrary to Mavenir's suggestion, Open RAN does not cover 1.3 billion subscribers (that number apparently is based on the total number of subscribers served by operators who are using equipment supplied by certain vendors).[34] There is only one large-scale commercial Open RAN network in operation in the world today, Rakuten,[35] which counts fewer than 5 million applications for service.[36] As of the end of the first quarter of 2021, commercially deployed 3GPP networks were serving 8 billion subscribers around the world, substantially fewer than 10 million of whom were served by Open RAN networks.[37]

Ericsson supports the facilitation of additional test beds to aid the development and maturing of Open RAN. A large number of commenters, including the Open RAN Policy Coalition, agree that "…[the Commission] should work to ensure that relevant actors fully fund innovation-promoting efforts such as testbeds, demonstration projects, and challenge competitions." In contrast to Mavenir's statement that "Open RAN does not require testbeds, or any particular tests different from those imposed on proprietary RAN networks, equipment, or software," Verizon states:

> Right now Verizon is playing a larger role with respect to Open RAN integration than it typically would in a vertically integrated RAN model. The more suppliers that are introduced in the RAN environment, the higher the interoperability testing complexity. At this point it is difficult to determine where the burden will ultimately fall – supplier or operator – in a more mature Open RAN environment.

Verizon concludes that "support for test beds and R&D would also be helpful" in order to understand these implications further.[38]

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[34] *See* Mavenir Comments at 34.
[35] *See* Caroline Gabriel and Roberto Kompany, *Open RAN: ready for prime time?*, at 1, Analysys Mason, Apr. 2021, https://www.analysysmason.com/research/content/white-papers/open-ran-reality-rdns0-rma18.
[36] *See* Brian Fletcher, *Rakuten Mobile losses rise to $887 million in Q1*, FIERCE WIRELESS, May 13, 2021, https://www.fiercewireless.com/operators/rakuten-mobile-losses-rise-to-887-million-q1.
[37] *See 5G Commercial Networks Are Now Live In More Than 60 Countries*, Feb. 11, 2021, https://gsacom.com/press-release/5g-commercial-networks-are-now-live-in-more-than-60-countries/. As of the end of 2020, there were over 400 million 5G subscribers globally. *See* LTE and 5G Subscribers: March 2021 – Q4, https://gsacom.com/paper/lte-and-5g-subscribers-march-2021-q4/.
[38] Verizon Comments at 9-10.

VI. CONCLUSION

Ericsson has been, and remains, proud to be a part of America's 5G successes. As evidenced by its own activities and products, Ericsson supports the evolution to more open network architectures. There is broad support in the record from commenters, including Ericsson, that the best way to achieve the Commission's goals are to 1) continue its policy of promoting technological neutrality, allowing for market-based network architecture decisions without mandates; 2) foster a diverse, trusted market of suppliers; 3) embrace policies promoting 5G deployment—including greater access to spectrum and infrastructure while expanding wireless coverage to underserved areas; and 4) support testbed and collaborative efforts—including American participation in crucial standard-setting bodies—that will advance 5G proliferation and ensure the continued development of open networks from a healthy ecosystem of vendors.

Respectfully submitted,

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